REMARKS

Status of Claims

As of this amendment, Claims 1, 5-10, 14-19, 22-31, 34-40, and 43-48 are pending in the instant application, and of these, Claims 1, 10, 19, 26, 31, 36-38 and 43-44 are currently being amended and Claims 45-50 are being added. Claims 20, 32 and 41-42 are being cancelled.

The amendments to claims 1, 10, 19, 26, 31, 36-38 and 43-44 are fully supported by the Specification, Claims as originally filed, and Drawings. No new matter is being added. For example, the addition of a beam receiving portion having a substantially conical surface to Claims 1, 10, and 26 is supported by at least paragraph 23 of the Specification. The addition of a beam receiving portion having a substantially concave or substantially conical surface to Claim 19 and 31 is supported by at least the same paragraph. The addition of negative biasing to Claim 31 is supported by at least paragraph 15 of the Specification. The addition of a beam receiving portion, a tapered tip, a localized electric field at the tapered tip, and adjusting an electromagnetic radiation beam to maintain the cathode at a setpoint temperature to Claim 36 are supported by at least Specification paragraphs 21, 16, 17, and 26, respectively. The addition of a tapered tip, and adjusting the electromagnetic radiation beam to Claim 37 is supported by at least Specification paragraphs 16 and 26 respectively. The addition of a tapered tip to Claim 38 is supported by at least paragraph 16 of the Specification. The addition of a tapered tip and a beam receiving portion consisting essentially of metal to Claims 43 and 44 is supported by at least Specification paragraphs 16 and 23, respectively. Thus, the claim amendments are fully supported and no new matter has been added. Entry of the amendments is respectfully requested.

New claims 45-48 are also fully supported by the Specification, Claims as originally filed, and Drawings. No new matter is being added. For example, new Claim 45 is supported at least by original Claims 19-20 and Specification paragraphs 16-17. New Claim 46 is supported at least by paragraph 23 of the Specification. New Claim 47 is

supported by at least paragraphs 24 and 26 of the Specification. New Claim 48 is supported by at least paragraph 15 of the Specification. New Claims 49 and 50 are supported by at least paragraph 15 of the Specification. Thus, the new claims are fully supported and no new matter has been added. Entry of the claims is respectfully requested.

Allowed Claims

The Examiner has indicated allowance of Claims 1, 5-10, 14-18, 23-30, 34-35.

Allowed Claims 1, 10, and 26 have been amended to further recite a substantially conical surface, as an alternative embodiment to the substantially concave surface. It is believed that this should be allowable for the same reasons indicated by the Examiner for the allowance of Claims with the limitation of a substantially concave surface, namely that none of the cited references teaches a substantially concave or substantially conical surface of the beam receiving portion of the cathode.

Objection to Claims 41 and 42

The Examiner objected to Claims 41 and 42 because the phrase "the beam-receiving portion" lacked antecedent basis. Claims 41 and 42 have been cancelled for other reasons, so this objection is obviated.

Rejection of Claim 19 under 35 USC 102(b)

The Examiner rejected Claim 19 under 35 USC 102(b) as being anticipated by U.S. Patent No. 5,942,834 to Davis.

The Examiner has indicated in the Allowable Subject Matter section of the Office Action mailed on 9/11/2003 that Claim 41, which is dependent on Claim 19, would be allowable over the cited references if rewritten in independent form. The limitation of

Claim 41 has been incorporated into Claim 19, thus it is believed that Claim 19 should now be allowable, obviating the rejection under 35 USC 102(b) over Davis. Furthermore, Claim 19 has also been amended to recite a substantially conical surface, as an alternative embodiment, in addition to the substantially concave surface. It is believed that this should be allowable for the same reasons indicated by the Examiner, namely that none of the cited references teaches a substantially conical surface of the beam receiving portion of the cathode.

Rejection of Claim 43 under 35 USC 102(e)

The Examiner rejected Claim 43 under 35 USC 102(e) as being anticipated by U.S. Patent No. 6,215,128 to Mankos et al. This rejection is respectfully traversed.

Claim 43 is not anticipated by Mankos et al. because Mankos et al. does not teach "[a]n electron source comprising: an anode; a cathode comprising an electron emitting portion and a beam-receiving portion, the electron emitting portion having a tapered tip, the beam-receiving portion consisting essentially of metal; an electromagnetic radiation source adapted to generate an electromagnetic radiation beam to heat the cathode; and a lens adapted to direct the electromagnetic radiation beam onto the beam-receiving portion of the cathode, whereby electrons are emitted from the tapered tip of the electron emitting portion" as recited in the claim as amended.

Instead, Mankos et al. discloses a "photoemission cathode 32 [which] is for example a thin gold (or other metal) layer deposited on a transparent substrate," (column 3, lines 65-67), which is shown in Figure 1 to be a flat transverse layer. This is different than a cathode comprising an electron emitting portion having a tapered tip. Mankos does not teach or disclose a cathode having a tapered tip. A tapered tip is important to provide a localized, directed stream of electrons. Mankos also does not teach a beam receiving portion consisting essentially of metal, as recited in the claim. Mankos instead discloses a thin metal layer on a transparent substrate. Thus, Claim 43, and those claims dependent therefrom, are not anticipated by, and thus patentable over Mankos et al.

Rejection of Claim 22 under 35 USC 103(a)

The Examiner rejected Claim 22 under 35 USC 103(a) as being unpatentable over Davis in view of Japanese Publication No. 5-159694 to Nayama et al.

The Examiner has indicated that Claim 41, which is dependent on Claim 19, would be allowable over the cited references if rewritten in independent form. The limitation of Claim 41 has been incorporated into Claim 19, thus it is believed that Claim 19 should now be allowable. Since Claim 22 depends on Claim 19, Claim 22 should also now be allowable, obviating the rejection under 35 USC 103(a) over Davis in view of Nayama. Claim 19 has also been amended to recite a substantially conical surface, as an alternative embodiment, in addition to the substantially concave surface. It is believed that this should be allowable for the same reasons as indicated by the Examiner.

Rejection of Claims 36-37 under 35 USC 103(a)

The Examiner rejected Claims 36-37 under 35 USC 103(a) as being unpatentable over Mankos et al. in view of Nayama et al. This rejection is respectfully traversed.

Claim 36

Claim 36 is patentable over Mankos et al. in view of Nayama et al. because neither of these references teach a method comprising "(a) negatively biasing the cathode relative to the anode to generate a localized electric field at the tapered tip of the electron emitting portion of the cathode; (b) directing an electromagnetic radiation beam onto the beam receiving portion of the cathode to heat the cathode; and (c) determining a temperature of the cathode and adjusting the electromagnetic radiation beam to control the amount of heat applied to the cathode to maintain the cathode at a setpoint temperature" as recited in the claim as amended.

Instead, Mankos et al. discloses directing a light source onto the photosensitive backside of a photocathode, which is shown in Figure 1 to be a flat transverse layer, and applying an electric voltage to an extraction electrode associated with the photoemission cathode. Mankos et al. does not teach biasing the cathode to generate a localized electric field at the tapered tip, as recited in the claim. Generating a localized electric field at the tapered tip is needed to emit a directed stream of electrons from the tip. Mankos et al. also does not teach determining the temperature of the cathode, and maintaining the temperature at a setpoint by adjusting the electromagnetic radiation beam. In fact, Mankos et al. does not teach any type of cathode temperature or cathode temperature control, nor the importance of the same.

Nayama et al. does not make up for the deficiencies of Mankos et al. Instead, Nayama et al. discloses a cathode heated by a laser beam, and a temperature controller to monitor and control the temperature of the cathode. This is different than the method of Claim 36. Nayama et al. does not teach negatively biasing the cathode relative to the anode to generate a localized electric field at the tapered tip of the electron emitting portion of the cathode to extract electrons. Instead, Nayama et al. heats the cathode with a laser to thermally generate electrons, or thermal excitation.

Furthermore, it would not be obvious to combine the disclosures of Mankos et al. and Nayama et al. because there is no motivation to combine these references. Mankos et al. and Nayama et al. teach methods of electron generation that are different from each other. Mankos et al. discloses a method of generating electrons based on photoemission, or in other words, exciting electrons with an incident beam of radiation. Nayama et al. discloses generating thermions, or in other words, generates electrons through thermal excitation. The instant Application teaches generating electrons through the application of a localized electric field to the electron emitting portion while directing an electromagnetic radiation beam onto the beam receiving portion of the cathode. Each of these methods depends on a different principle, and thus the parameters that control and potentially enhance each method are also different. It would not be obvious to use the techniques of Nayama et al, that is, to apply heat or monitor the cathode temperature, in the instant Application, because the method of Nayama et al is primarily based on the

application of heat, whereas the method of generating electrons in the instant Application is primarily based on generating and applying voltages and electric fields.

Thus, claim 36, and those claims dependent therefrom, are patentable over Mankos et al. in view of Nayama et al.

Claim 37

Claim 37 is patentable over Mankos et al. in view of Nayama et al. because neither of these references teach "[a]n electron source comprising: an anode; a cathode comprising an electron emitting portion having a tapered tip; an electromagnetic radiation source adapted to generate an electromagnetic radiation beam to heat the cathode; a lens adapted to direct the electromagnetic radiation beam onto the cathode; and a thermostat adapted to determine a temperature of the cathode and adjust the amount of heat applied to the cathode by adjusting the electromagnetic radiation beam, whereby electrons are emitted from the tapered tip of the electron emitting portion" as recited in the claim as amended.

Instead, Mankos et al. discloses a light source directed onto the photosensitive backside of a photocathode, which is shown in Figure 1 to be a flat transverse layer, and an electric voltage applied to an extraction electrode associated with the photoemission cathode. Mankos et al. does not teach or disclose a tapered tip of the electron emitting portion, which will generate a localized, directed stream of electrons. Mankos et al. also does not teach a thermostat to determine the temperature of the cathode and adjust the electromagnetic radiation beam to maintain the cathode temperature at a setpoint. In fact, Mankos et al. does not teach any type of cathode temperature or cathode temperature control, nor the importance of the same.

Nayama et al. does not make up for the deficiencies of Mankos et al. Instead, Nayama et al. discloses a cathode heated by a laser beam, and a temperature controller to monitor and control the temperature of the cathode. This is different than the cathode and electromagnetic radiation source of Claim 37. Nayama et al. does not teach

a cathode negatively biased relative to the anode to generate a localized electric field at the tapered tip of the electron emitting portion of the cathode to extract electrons. Instead, Nayama et al. heats the cathode with a laser to thermally generate electrons.

Furthermore, it would not be obvious to combine the disclosures of Mankos et al. and Nayama et al. because there is no motivation to combine these references. Mankos et al. and Nayama et al. teach apparatuses to generate electrons that use different principles from each other. Mankos et al. discloses an apparatus to generate electrons based on photoemission, or in other words, exciting electrons with an incident beam of radiation. Nayama et al. discloses an apparatus to generate thermions, or in other words, to generate electrons through thermal excitation. The instant Application teaches an apparatus to generate electrons through the application of a localized electric field to the tapered tip of the electron emitting portion while directing a electromagnetic radiation beam at the beam receiving portion of the cathode. Each of these apparatuses depends on a different principle, and thus the parameters that control and potentially enhance each are also different. It would not be obvious to use the techniques of Nayama et al, that is, to have a heated cathode or a temperature monitor, in the instant Application, because the apparatus of Nayama et al. is primarily based the application of heat, whereas the apparatus of the instant Application is primarily based on generating and applying voltages and electric fields.

Thus, claim 37, and those claims dependent therefrom, are patentable over Mankos et al. in view of Nayama et al.

Rejection of Claims 19-20, 31-32, and 38 under 35 USC 103(a)

The Examiner rejected Claims 19-20, 31-32, and 38 under 35 USC 103(a) as being unpatentable over Mankos et al. in view of Davis. This rejection is respectfully traversed.

Claim 19

The Examiner has indicated that Claim 41, which is dependent on Claim 19, would be allowable over the cited references if rewritten in independent form. The limitation of Claim 41 has been incorporated into Claim 19, thus it is believed that Claim 19 should now be allowable, obviating the rejection under 35 USC 102(a) over Mankos et al. in view of Davis. Furthermore, Claim 19 has also been amended to recite a substantially conical surface, as an alternative embodiment, in addition to the substantially concave surface. It is believed that this should be allowable for the same reasons indicated by the Examiner, namely that none of the cited references teaches a substantially conical surface of the beam receiving portion of the cathode.

Claim 31

The Examiner has indicated that Claim 42, which is dependent on Claim 31, would be allowable over the cited references if rewritten in independent form. The limitation of Claim 42 has been incorporated into Claim 31, thus it is believed that Claim 31 should now be allowable, obviating the rejection under 35 USC 102(a) over Mankos et al. in view of Davis. Furthermore, Claim 31 has also been amended to recite a substantially conical surface, as an alternative embodiment, in addition to the substantially concave surface. It is believed that this should be allowable for the same reasons indicated by the Examiner, namely that none of the cited references teaches a substantially conical surface of the beam receiving portion of the cathode.

Claim 38

Claim 38 is patentable over Mankos et al. in view of Davis because neither of these references teach "an electron source comprising: an anode; a cathode comprising an electron emitting portion having a tapered tip; an electromagnetic radiation source adapted to heat the cathode to at least about 1800 Kelvin by generating an electromagnetic radiation beam and directing the electromagnetic radiation beam onto the cathode; and a lens adapted to direct the electromagnetic radiation beam onto the

cathode, whereby electrons are emitted from the tapered tip of the electron emitting portion" as recited in the claim as amended.

Instead, Mankos et al. discloses a photoemission cathode, which is shown in Figure 1 to be a flat transverse layer, a light source to direct light onto the photoemission cathode, and an electric voltage applied to an extraction electrode associated with the photoemission cathode. This is different than the electron source of Claim 38. Mankos et al. does not teach an electron emitting portion of the cathode having a tapered tip. The tapered tip is important to generate a localized stream of electrons. Instead, Mankos teaches a flat transverse layer that needs to be masked in order to generate a single stream of electrons. Mankos et al. also does not teach an electromagnetic radiation source adapted to heat the cathode to at least 1800 Kelvin. Mankos et al. is silent with respect to heating the cathode.

Davis does not make up for the deficiencies of Mankos et al. Instead, Davis discloses heating a cathode, which could be curved, with a heat source, which could be a laser. This is not the same as the electron source of Claim 38. As with Mankos et al., Davis does not teach a cathode with an electron emitting portion having a tapered tip. Instead, Davis discloses a cathode which can be flat or curved.

Furthermore, there is no motivation to combine the disclosures of Mankos et al. and Davis. Mankos et al. and Davis do not teach an electron emitting portion of the cathode having a tapered tip, nor do they teach, suggest, or provide motivation for the desirability of having the same. Furthermore, there is no motivation to combine the fundamentally different electron generating apparatuses of Mankos et al. and Davis. Mankos et al. teaches a photoemission electron generation apparatus, whereas Davis teaches thermal electron generation apparatus. These apparatuses rely on different principles of electron generation, and thus it would not be obvious to apply portions of one apparatus to the other.

Thus, Claim 38, and those claims dependent therefrom, are patentable over Mankos et al. in view of Davis.

Rejection of Claim 44 under 35 USC 103(a)

The Examiner rejected Claim 44 under 35 USC 103(a) as being unpatentable over Mankos et al. in view of Allen et al. This rejection is respectfully traversed.

Claim 44 is patentable over Mankos et al. in view of Allen because neither of these references teach "[a]n electron beam apparatus to register an electron beam pattern on a substrate, the apparatus comprising: a vacuum chamber; a substrate support to support a substrate; an electron source to provide an electron beam in the vacuum chamber, the electron source comprising (a) an anode, (b) a cathode comprising an electron emitting portion and a beam-receiving portion, the electron emitting portion having a tapered tip, the beam-receiving portion consisting essentially of metal, (c) an electromagnetic radiation source adapted to generate an electromagnetic radiation beam to heat the cathode, and (d) a lens adapted to direct the electromagnetic radiation beam onto the beam-receiving portion of the cathode; and an electron beam modulator and scanner to modulate and scan the electron beam across the substrate to register an electron beam pattern on the substrate, whereby electrons are emitted from the tapered tip of the electron emitting portion" as recited in the claim as amended.

Instead, Mankos et al. discloses a photoemission cathode which is a thin metal layer deposited on a transparent substrate. This is different than the cathode recited in claim 44. Mankos et al. does not teach or disclose a cathode having a tapered tip. A tip is important to provide a localized, directed stream of electrons. Mankos et al. also does not teach a beam receiving portion consisting essentially of metal, as recited in the claim. Mankos et al. instead discloses photocathode which is a thin metal layer on a transparent substrate.

Allen et al. does not make up for the deficiencies of Mankos et al. Instead, Allen et al. discloses a photocathode, which is a flat layer, on a transparent substrate. Allen et al. does not teach a cathode consisting essentially of a beam emitting portion having a tapered tip. Allen et al. also does not teach a beam-receiving portion consisting

essentially of metal. Instead, Allen et al. discloses a photocathode comprises a "thin layer of gold, cesiated gallium arsenide, or cesiated semiconductor film" (column 4, lines 40-41). A semiconductor is different than a metal.

Furthermore, Mankos et al. and Allen et al. do not teach an electron emitting portion of the cathode having a tapered tip, nor do they teach, suggest, or provide motivation for the desirability of having the same. Mankos et al. and Allen et al. also do not teach or suggest a beam receiving portion consisting essentially of a metal, nor do they provide motivation for having the same. In contrast, the Specification of the instant Application provides motivation in paragraph 23, namely that a metal effectively absorbs the energy of the electromagnetic radiation beam.

Thus, Claim 44, and those claims dependent therefrom, are patentable over Mankos et al. in view of Allen et al.

Added Claim 45

New Claim 45 is believed to be patentable because none of the cited references teach or suggest both negatively biasing the cathode to generate a localized electric field at the tapered tip of the electron emitting portion of the cathode, and directing an electromagnetic radiation beam onto the beam receiving portion of the cathode to heat the cathode, as recited in the claim.

CONCLUSION

The above-discussed amendments and remarks are believed to place the present application in condition for allowance. Should the Examiner have any questions regarding the above remarks, the Examiner is requested to telephone Applicant's representative at the number listed below.

Respectfully submitted,

JANAH & ASSOCIATES, P.C.

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By: _____
Ashok K. Janah
Reg. No. 37,487

Please direct all telephone calls to:

Ashok K. Janah
(415) 538-1555

Please continue to send correspondence to:

APPLIED MATERIALS, INC.
Patent Department, M/S 2061
P.O. Box 450A
Santa Clara, California 95052

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